Received: October, 2025 Revised: January, 2026-03-29 Accepted: March, 2026

DOI : https://doi.org/10.3126/npj.v19i1.92894

Childhood Mortality in Nepal: Further Analysis of Nepal Demographic and Health Survey, 2022

Pawan Kanel[1]

[1] Lecturer, Central Department of Population Studies (CDPS), Tribhuvan University Email: kanelpawan@gmail.com

ABSTRACT

This paper identifies the determinants effecting childhood mortality in Nepal using Nepal Demographic Health Survey 2022 (child) database by executing adjusted and stepwise logistic regression analysis. At the National level, the model (N=5372) identifies that number of children under 5 years, children ever born (CEB), births in the past 5 years, respondents desire for more children and sex of the child as strong predictors of childhood mortality. These same variables are also significant predictors for almost all the provinces. In addition to these indicators, age at first cohabitation, home delivery, employment and partner's education for Koshi; rural/urban residence, partner's education and Hindu religion for Madhesh; age at first birth, Hindu religion and partner's education for Bagmati; joint decision on contraception and mother's education for Lumbini; and twin child and age at first birth for Sudur Paschim Province are strong determinants effecting childhood mortality across the provinces of Nepal. If SDG Goal 3 Target 3.2 is to be met, these indicators need to be addressed immediately.

Keywords: Childhood mortality, determinants, NDHS and SDG 3

INTRODUCTION

Childhood morality patterns in developing countries are like what developed countries experienced a few decades ago. So, it is essential to understand the global childhood mortality patterns before examining childhood mortality patterns in developing countries. Abdel Omran's (1971, 1981) Epidemiological Transition Theory explains how transitions from pandemics of infection are gradually displaced by degenerative, stress-related and man-made diseases. The changes in patterns of disease result in shifts in the average age at death, from infancy, childhood, and young adulthood to older ages, with corresponding increase in the life expectancy. These improved chances of survival selectively favour the young over the old and women more than men, resulting in changes in the age and sex structure of the population. This transition is associated in varying degrees with social, economic and medical

developments. With this foundation in mind, the reasons for childhood mortality are explored to develop a conceptual framework essential to guide this paper towards meeting its objectives.

The frameworks of Meegama (1980), Garenne and Vimard (1984), Mosley and Chen (1984) and Palloni (1985) that covered diverse regions of the world is reviewed to gather some perspective on child survival in developing countries. In their study, Meegama (1980) and Mosley and Chen (1984) covered Asia, Garenne and Vimard (1984) Africa and Palloni (1985) covered Latin America. According to Grenne and Vimard (1984), the levels of mortality in childhood is influenced by the geographical area (rural-urban residence), economic development (household incomes, health infrastructure, access to health care), political system (income distribution), social category (parent's education, status of the child, mother's occupation) and housing conditions (quality of housing, overcrowding). Mosley and Chen's (1984) framework incorporates both social and biological variables and integrates research methods employed by social and medical scientists to understand child survival in developing countries. Maternal factors, environmental conditions, the nutritional status and injury related variables are affected by socioeconomic factors which determine mortality of a child. Interventions like personal illness control, treatment of the illness and prevention will improve the health status of a child. Palloni's (1987) framework is action oriented and argues that individual characteristics (biological, childcare, maternal education), household characteristics (resources, overcrowding, family structure) and community characteristics (health system, access to services) are determining factors of morbidity and mortality. Based on an understanding of the frameworks provided above, this paper identifies five major categories namely socio-economic variables, maternal factors, nutritional variables, injury variables and personal illness control variables as the determinants effecting childhood mortality in Nepal.

Mortality rates in early years of life (neonatal, post-neonatal, infant, child and under 5 mortality rates) are constantly declining in Nepal (MoHP, 1996; MoHP, 2001; MoHP, 2006; MoHP, 2011; MoHP, 2016 and MoHP, 2023). For 2022, Nepal's neonatal mortality rate (NNMR), infant mortality rate (IMR) and under 5 mortality rates (U5MR) are 21, 28 and 33 deaths per thousand live births respectively. Figure 1 shows trends and patterns of mortality rates in early years of life in Nepal from 1996 till 2022 from the last six editions of the Nepal Demographic and Health Survey (NDHS).

METHODS

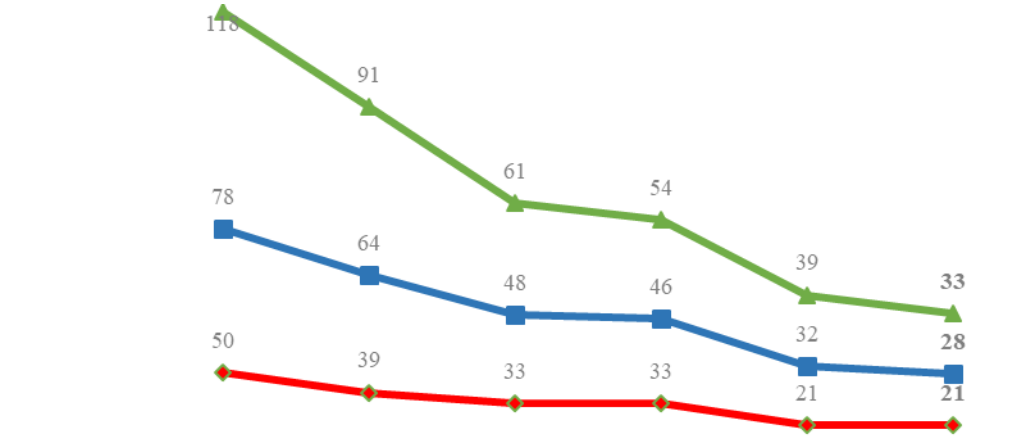
NDHS (2022), child dataset is analysed to identify the determinants of effecting childhood mortality in Nepal. The first step towards this begins by understanding the NDHS questionnaire and identifying the key variables. These variables are in-turn re-generated, renamed, and recoded into their desired names, labels and values and a final list of variables are selected.

Each variable is then thoroughly analysed. A Summary table helps to understand five key indicators: number of observation (N), mean, standard deviation, minimum value and maximum value. Except for a few variables, N is 5372. Then, frequency tables are examined,

cross tabulations of variables by childhood mortality are analysed and correlation matrix observed. Then, adjusted multiple logistic regression analysis and stepwise logistic regression analysis are executed to identify the determinants effecting childhood mortality in Nepal. Five models are generated keeping in mind the total number of observations available for each variable. The first model begins with all the variables. Then, variable/s with the largest number of missing observations is/are removed step by step in the same order until an appropriate model is generated. Model statistics and coverage (percentage of observations include in the model where N is 5372). The first four models are computed as: **Model I** – all variables, **Model II** – Model I less Anaemia_Level and Anaemia, **Model III** – Model II less EverBfed, Child_Size and Preg_Wanted and **Model IV** – Model III less Wanted_Child. Model statistics N, Chi-square values (Chi^2), p-value of Chi-square results (P>Chi), pseudo-R square (pR^2), Akaike information criterion (AIC) and Bayesian information criterion (BIC) values are analysed. The analysis suggests that Model I is the most appropriate model. However, the coverage percent is very low which is also important for provincial analysis as one would not want to disrupt the sampling design and our analysis to be unrepresentative. The coverage of observations in Models I–V are 24.50 percent, 57.20 percent, 70.17 percent, 98.73 percent, and 27.40 percent. Theoretically speaking, higher adjusted R squared values and lower AIC/BIC values are preferred for a model to be appropriate (Stata Corp, 2017). Keeping this in mind, models I and IV are selected for further analysis and the binary form of these are generated as Model V_a and V_b.

The odds ratio (OR) obtained from the models are used to explain the causal relationship between the dependent and independent variables. The unadjusted odds ratio help us understand the pattern of casualty between the independent variables and childhood mortality. This process also helps to determine the reference groups for multi-nominal variables). Adjusted odds ratio are then computed to examine the combined effect of the independent variables on childhood mortality followed by stepwise regression analysis. The odds ratio is interpreted as "a unit change in variable **x** (significant independent variable) increases/decreases ($+^{ve}$ / $-^{ve}$ OR) the occurrence in childhood mortality by **Y** percent."

Figure 1: Pattern of neonatal, infant and under 5 mortality rates (1996 – 2022).



	1996	2001	2006	2011	2016	2022
U5MR	118	91	61	54	39	33
IMR	78	64	48	46	32	28
NNMR	50	39	33	33	21	21

Source: MoHP et al., 2023

Sustainable Development Goal (SDG) 3 Target 3.2 aims to "end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under 5 mortality to at least as low as 25 per 1,000 live births by 2030". So, it is fair to say that 'Nepal still has a long way to go if it is to meet SDG Goal 3 Target 3.2 by 2030', especially, since nearly two-thirds of all under 5 deaths in Nepal occur at the first month of life (MoHP, 2022), and, also keeping in mind that NNMR is unchanged from NDHS 2016. This is also the overall objective of this paper. To achieve this objective, information on deaths between birth and 36 months, named childhood mortality from this point forward, is analysed using NDHS 2022 child database. NDHS 2022, the seventh of its version in Nepal, is the most updated, reliable and comprehensive dataset that allows childhood mortality analysis with respect to socio-economic, demographic, health and medical variables at national as well as provincial levels. However comprehensive it may be, NDHS 2022 database is confined to limited variables.

Mortality rates in early years of life also vary across the provinces (Table 1). U5MR of Sudur Paschim Province (49 per 1000 live births) and Karnali Province (46 per 1000 live births) is double or more compared to that of Gandaki Province (23 per 1000 live births). Madhesh and Lumbini also have very high U5MRs (43 and 41 respectively). The same pattern is also seen for NNMR and IMR. This fluctuation across the province provides more support for the claim for a new study, also implying that this new study should be more disaggregated. Mortality rates in early life furthermore vary according to the place of residence (urban/rural). National and Provincial mortality rates are higher for respondents residing in rural area compared to

their urban counterparts (except Lumbini where NNMR and U5MR are higher for urban areas than rural).

Mortality rates also fluctuate by mother's education and wealth quintile of the household. Mothers with no education (50) have higher U5MRs compared to mothers with basic (41) and secondary (24) education. The same also holds true for NNMR and IMR where mothers with 'no' or 'basic education' have a higher probability of dying compared to mothers with secondary and higher education. From the wealth quintile perspective, these rates are inversely proportional i.e. higher mortality rates for 'poorest' households followed by 'poorer', 'middle', 'richer' and 'richest' households (except neonatal and child mortality rates – highest for the 'poorer' category). To conclude, place of residence, mother's education and wealth quintile are important determinants effecting childhood mortality rates in Nepal.

Table 1: Neonatal, infant and under 5 mortality rates for the 10-year period preceding the survey, 2022

Characteristics	NN Mortality	PNN Mortality	Infant Mortality	Child Mortality	Under 5 Mortality
Place of Residence					
Urban	19	7	25	5	30
Rural	25	9	34	4	38
Province					
Koshi	**20**	**8**	**28**	**6**	**34**
Urban	14	7	22	7	29
Rural	30	11	40	3	43
Madhesh	**27**	**11**	**38**	**5**	**43**
Urban	22	11	33	6	38
Rural	41	12	53	3	57
Bagmati	**18**	**3**	**21**	**3**	**24**
Urban	17	0	17	2	19
Rural	21	12	33	6	40
Gandaki	**8**	**10**	**19**	**5**	**23**
Urban	(2)	(3)	(5)	(2)	(7)
Rural	20	24	44	8	52
Lumbini	**24**	**10**	**34**	**8**	**41**
Urban	26	9	35	5	40
Rural	21	12	33	10	43

Karnali	**26**	**11**	**36**	**10**	**46**
Urban	20	4	25	8	32
Rural	31	16	47	12	59
Sudurpashchim	**27**	**13**	**40**	**9**	**49**
Urban	20	7	27	9	36
Rural	37	21	59	8	67
Mother's Education					
No education	26	15	41	10	50
Basic education (1-8)	28	9	36	4	41
Lower basic education (1-5)	34	10	44	6	49
Upper basic education (6-8)	20	8	28	2	30
Secondary (9–12)	15	5	21	4	24
Lower secondary (9–10)	18	7	25	4	29
Higher secondary (11-12)	11	2	13	3	16
More than secondary (13 and above)	(7)	(1)	(8)	*	*
Wealth Quintile					
Poorest	26	19	45	9	53
Poorer	31	11	41	10	50
Middle	21	6	26	3	30
Rich	17	6	23	5	28
Richest	13	2	15	1	16

Source: MoHP, 2022

Note: Figures in parentheses are based on 250–499 unweighted person-years of exposure to the risk of death. An asterisk indicates that a rate is based on fewer than 250 person-years of exposure to the risk of death and has been suppressed.

Upon review of literature (provided in subsequent section) from different parts of the world (including Nepal), numerous variables are identified as significant factors effecting mortality in early years of life. This paper identifies them as: socio-economic, maternal factor, nutritional, injury and personal illness control variables (see theoretical framework) emphasizes that the analysis of childhood mortality, with respect to these five variables, will no doubt provide insights as to how and why childhood mortality fluctuates across the provinces and provide insights to support Nepal achieve SDG Goal 3 Target 3.2.

Socio-Economic Variables

A set of spatial, social and economic variables are selected as socio-economic variables. Under spatial variables, place of residence (rural/urban) and province are selected. MoHP (1996, 2001, 2006, 2011, 2016 and 2022) explain how mortality in early years of life varies across rural/urban residence, province and wealth quintile of households. Grenne and Vimard (1984) also argue that level of mortality in childhood is influenced by the geographical area (rural-urban residence) of the mother and child. Caldwell (1986) showed that low mortality in Costa Rica, Sri Lanka and Kerala was well explained by ethnicity, religion and culture. So, under the social set, ethnicity and religion of the mother is selected. He further suggested that low mortality would be achieved with the increase in female autonomy and increased modern health services and educational institutions. Caldwell (1979) advocated that mother's education affects the choice and place of residence and lifestyle, and, if the education level is high enough, gives rise to better living standards, which gives people access to more comfortable, better furnished and easier to maintain housing as well as to financial access to adequate health care. It also empowers her to negotiate the distribution of resources in favour of better care for her child and in decision making (Bell, 1985).

Paudel et al. (2013) witnessed that neonatal mortality was higher among middle and least wealthy households and among disadvantaged caste/ethnic groups and by mother's education and age of the mother. They identified that the urban/rural residence, mother's exposure to mass media, use of clean cooking fuel has substantial effects on infant and child mortality in India. They further point out that mother's literacy, household head's religion, and caste/tribe membership and economic level of the household were observed to have substantial and often statistically significant effects on infant and child mortality. Employment status of the mother, occupation status and wealth quintile are selected as the economic set of socio-economic variables. Luther and Thapa (1999) highlighted background characteristics such as mother's education, residence and standard of living to have strong effects on infant and child mortality in developing countries as they are most likely to affect the biological conditions by their influence on mother's health condition before and during pregnancy. Bhattarai (2008) identified eighteen variables to be strong predictors of Acute Respiratory Infections (ARI) in Nepal, one of the leading causes of childhood mortality in Nepal. Among them, place of residence, religion, working status in last 12 months, occupation and household consumption wealth quintile as determinants effecting ARI in Nepal.

Maternal Factors

Caldwell (1986, 1979) established that the level of education (specifically, mother's education) is the most discriminating characteristic as far as child's survival is concerned. Caldwell and McDonald (1981) and Luther and Thapa (1999) further reinstate this. MoHP (2022) provides support to state that this statement holds true in the context of Nepal also. Paudel et al. (2013) state that neonates born to mothers without education have twice the odds compared to mothers who had at least primary education. Kanel (2010) also identified mothers' education as a significant predictor of childhood mortality. Luther and Thapa (1999) point out that young mothers, children of high birth order and children's previous birth

interval are strong predictors of infant and child mortality in Nepal. Younger mothers are more likely to be uneducated, unemployed and subsequently poorer. They also observed that first order births had a greater risk of childhood death compared to subsequent infants. This increased risk of childhood mortality among first-born children may be attributed to the fact that a substantial proportion of Nepalese women gave birth before they reached 20 years (MoHP, 2023). Shah et al. also identified that mothers aged less than 20 years had higher risk of childhood mortality compared to older mothers.

Ghimire et al. (2019) noted mothers aged <20 years, and those who reported of having a first birth were significantly associated with neonatal, post-neonatal, infant and under-five mortality. The increased risk of childhood mortality among first-born children is attributed to the fact that a substantial proportion of Nepalese women gave birth before they reached 20 years of age (MoHP, 2001, 2006, 2011, 2016 and 2023). A conceivable explanation to this may be due to younger mother's physical and reproductive immaturity as well as poor nutritional intake during pregnancy, which often leads to low birth weight. More importantly, young mothers are infrequent users of maternal health care services (Kamal, 2015). Paudel et al. (2013) witnessed that for both 2001 and 2006, babies born after a short birth interval (under two years) have roughly twice the odds of neonatal death, compared with babies born after an interval of at least two years. Keeping this in mind, set of educational and demographic variables are selected as maternal factor variables.

Male neonates, those with birth weight less than 2,500 grams and unweighted/other weight babies, neonates born later, and neonates born with a birth interval of less than 3 years had the highest NMR (Singh et al., 2019). Besides birth weight, pregnancy duration and the presence of anomalies, the male mortality disadvantage is the rule, at least until the first birthday.

Nutritional Variables

The nutritional hypothesis proposed by Thomas McKeown (1976) argues that reductions in the lethality of infectious diseases were brought about by improved living conditions in general and better nutrition in particular. Blanc (1991) estimated that malnutrition is associated with 60 percent of deaths in childhood for developing countries. Maternal malnutrition is also partly responsible for the high proportion of low-birth-weight children reported in some estimations (Kramer, 1987). Paediatricians have for a long-time recognized birth weight as an indicator of a child's frailty. If it is less than 2500g, it is identified as low birth weight; if it is less than 1500g, it is very low birth weight (Kramer 1987, cited in Masuy-Stroobant, 2006). Accoding to Kramer, birth weight is probably the single most factor that affects neonatal mortality, in both developed and developing countries, in addition to being a significant determinant of post-neonatal, infant and childhood morbidity. Medical research noticed a higher weight gain among breast-fed new-born babies as compared to bottle-fed babies. Improvement in infant nutrition accompanied by a general economic and social development is essential for child survival. Nutritional variables are classified as child and mother variables. Size of the child at birth and whether the child was ever breastfed are child nutritional variables under nutritional variables.

Gubhaju (1991) and MoHP et al. (2007) state that nutritional deficiencies is a leading cause of childhood mortality in Nepal. According to Masuy-Stroobant (2006), preventive measures can start before conception and continue during pregnancy. Daily preventive measures can be summed up as living a healthy life, not overtiring oneself, avoiding stress and heavy or tenuous work, having a balanced diet and using vitamin supplements to manage preexisting deficiency (anemia). Literature suggests that iron deficiency is the most common cause of maternal anaemia; and anaemia during pregnancy is associated with higher risk of prematurity and low birth weight (Haider et al., 2012; Imdad et al, 2012). Surprisingly, neonatal mortality rate in 2011 was lower among anaemic mothers (31 deaths per 1,000 live births) than among non-anaemic mothers (36 deaths per 1,000 live births) like the pattern of 2006 (Paudel et al., 2013). Nonetheless, information on the anemia level is considered as a nutritional variable for the mother.

Injury Variables

Masuy-Stroobant (2006) identified medical and daily preventive behaviour as significant determinants of child health. Under medical preventive behaviour, mother's age at the birth of child, number and spacing of births, the last birth interval adopted by the mother, identification of risk factors in her past pregnancy history (miscarriages, preterm, births, infant deaths, pregnancy termination) are the recommended preventive behaviours for safe delivery and to maintain her child in good health. Twin births represent an increased risk because they are often preterm births. Though literature regarding whether a mother wanted her last pregnancy and child is not available, this study believes that mothers who did not want their last pregnancy/child are less likely to care for themselves/child during and right after pregnancy, nutritionally or health care seeking behaviour, and so are more prone towards injuries. So, under injury variables, wanted last pregnancy, pregnancy terminated, wanted last child and child is twin are selected.

Personal Illness Control

Caldwell (1991) identified health service and health professional as crucial factors that increase child survival. Masuy-Stroobant (2006) argues that childbirth should, if possible, take place in a hospital equipped to cope with "labour dystocia" and high-risk births. Gubhaju (1991) and MoHP et al. (2007) have pointed out that absence of proper medical facilities and services are the leading causes of childhood mortality in Nepal. They further argue that preventive measures can start before conception and continue during pregnancy by early prenatal care and the search for signs of acquired immunity by the mother (e.g. tetanus, rubella and the likes).

Ghimire et al. (2019) and Shah et al. (2013) identified that use of contraceptives would reduce childhood mortality by creating a long birth interval. If the user is the decision maker for use/non-use and method of contraceptives, then that is also recognized as a personal illness control. The generalized access to education and the development of effective contraception gave rise to an unprecedented improvement in women's status in societies (Kramer 1987, cited in Masuy-Stroobant, 2006). Ghimire et al. (2019) identified mothers who reported previous

death of a child, who did not receive TT vaccines during pregnancy, and non-use of contraceptives among mothers were found to be associated with neonatal, post neonatal, infant, child or under-five mortality. Mothers who were nonusers of contraception were significantly more likely to have a child death in all age subgroups. Shah et al. (2013) suggested that use of contraceptives would reduce child mortality by creating a long birth interval and the impact of short birth intervals on child survival. They also found out that mothers aged less than 20 years had higher risk of neonatal, post neonatal, infant and under-five mortality compared to older mothers. Additionally, younger mothers are more likely to be uneducated, unemployed and subsequently poorer. They also found that the first order births had a greater risk of childhood death compared to subsequent infants.

A similar study by Singh et al. (2019) estimated NNMRs for live births in the 10 years preceding the survey (NDHS 2016) and showed that they were highest in the mountain region, Lumbini Province, rural areas, and in the poorest wealth category. Maternal factors were also significant in neonatal mortality. For example, neonates born to women with no education, women younger than age 25, women who have not heard at least one public health media program, and multiple pregnancies (twin, triple or more babies in one pregnancy) had the highest NNMR. The NNMR also differed by maternal service use during the prenatal, natal, and postnatal period and by place of delivery. The lowest NMR was observed in Province 4 (Gandaki Province), the richest wealth quintile, neonates with normal weight at birth, and those born in a 3-year gap. Paudel et al. (2013) observed that mothers who were better prepared to give birth had a lower neonatal death compared to mothers who were poorly prepared. NNMR in the five years preceding the survey among those who were delivered at a health institution was 26, lower than the rate of 36 among those who were delivered elsewhere. Based on this literature review, the conceptual framework of this paper, in short, explains that childhood mortality is determined by a set of socio-economic, maternal factor, nutritional, injury and personal illness control variables

RESULTS AND DISCUSSION

Results from data analysis are presented under two sub-sections: national level analysis and provincial level analysis. The results from adjusted and stepwise logistic regression analysis are presented separately for both national and provincial level analysis.

National Level Analysis

Analysis of model statistics (Model I to IV) suggests that Model I is the best model, high pR^2 values (0.762) and lower AIC/BIC values. The coverage of this model, however, is very low. It represents only 24 percent of total sample size while Model IV represents nearly 97 percent of total sample size. Also, for provincial analysis, larger sample size is preferred. To simplify this, both Model I and IV are selected. This in turn demands for two separate binary analysis models (Model V_a and V_b), for Model I and Model IV respectively (Table 2).

Table 2: Adjusted multiple logistic regression analysis results from models I – V

Name	N	Coverage (%)	Chi^2	$P>Chi^2$	pR^2	AIC	BIC
Model I	1292	24.05	259.997	0.000	0.762	215.209	561.194
Model II	3016	56.14	405.288	0.000	0.566	454.931	887.772
Model III	3700	68.88	355.846	0.000	0.328	857.594	1261.640
Model IV	5206	96.91	453.381	0.000	0.335	1028.808	1455.050
Model V_a	1445	26.90	217.637	0.000	0.620	217.524	439.110
Model V_b	5237	97.49	414.033	0.000	0.306	1017.883	1273.859

Source: NDHS, 2022

Stepwise logistic regression analysis of Models I, IV, V_a and V_b, provided in Table 3, shows similar patterns to that of Table 2. Coverage percent of the model slightly increases and pR^2 values slightly decrease but the overall pattern is the same.

Table 3: Stepwise logistic regression analysis statistics (selected models)

Statistics	N	Coverage (%)	Chi^2	$P>Chi^2$	Log Likelihood	pR^2
Model I	1,391	25.89	220.45	0.000	-63.4145	0.6348
Model IV	5,209	96.97	419.27	0.000	-466.567	0.3100
Model Va	1,445	26.90	190.57	0.000	-80.2953	0.5427
Model Vb	5,237	97.49	393.69	0.000	-480.114	0.2908

Source: NDHS, 2022

Model I: N for the adjusted model is 1292 and this value is only 24.05 percent of the total available sample size. The pR2 of the model is 0.762 which is extremely high. AIC and BIC values are the lowest among the models at 215.209 and 561.194 respectively. The model finds N5Child, EverBfed and Occupation: Did Not Work significant at 1 percent along with Occupation: Ag-Self Emp. (0.001), Rur_Urb (0.027), Wealth_Qnt: Poorest (0.000), HHHead_Sex (76.810), Wealth_Qnt: Poorer (0.003), WIFS (1.000), Ethnicity: Other Tarai Caste (39.462), Ethnicity: Higher Caste (0.005), and Partner_CYS (0.610) significant at 5 percent.

The stepwise model shows N is merely 1391 with only about 25 percent coverage. The pR2 of this model is also extremely high (0.6348). The model indicates N5Child (0.054), Birth_5yr (9.862), EverBfed (0.001), Ethnicity: Other Tarai Caste (56.252), Wealth_Qnt: Medium (1157.480), Ethnicity: Muslim (68.314), Ethnicity: Hill and Tarai Janjati (44.435), Wealth_Qnt: Poorer (85.969), WIFS (1.000) and Ethnicity: Dalit (36.759) significant at 1 percent. Likewise, HHHead_Sex (6.483), Child_Twin (26.114), Wealth_Qnt: Richest

(26212.240), Wanted_Child (6.552), CEB (2.238), and Wealth_Qnt: Richer (788.465) are significant at 5 percent.

Model IV: The total number of observations for this model is 5,206. The Chi^2 value is 453.318, $P>Chi^2$ is 0.000, pR^2 is 0.335, AIC is 1028.808 and BIC is 1455.050. N5Child (0.158), CEB (2.204), Birth_5yr (7.349), Desire_Child: Doesn't Want More (0.159), Desire_Child: Sterilized or Infecund (0.124) and Child_Sex (2.045) are significant at 1 percent. The odds of childhood mortality increase for CEB, Birth_5yr and Child_Sex whereas it decreases for N5Child, Desire_Child: Doesn't Want More and Desire_Child: Sterilized or Infecund. Similarly, employed (2.014) and More1Union (2.396) are significant at 5 percent; and Age_1Birth (1.156), Desire_Child: Undecided (0.477), Age_Gr: 25-29 (2.679), Province: Sudur Paschim (2.552), CYS (0.878) and Province: Koshi (2.077) at 10 percent.

Stepwise logistic regression analysis shows CEB (2.108), Desire_Child: Sterilized/Infecund (0.152), N5Child (0.178), Desire_Child: Doesn't Want More (0.174), Birth_5yr (7.115), Child_Sex (1.929) and Partner_CYS (0.916) are significant at 1 percent. The odds of childhood mortality increase with increase in CEB, Birth_yr and when the sex of child is male. Correspondingly, the odds of childhood mortality decrease for Desire_Child: Sterilized/Infecund, Desire_Child: Doesn't Want More, N5Child and Partner_CYS. Likewise, Age_1Birth (1.145), CYS (0.868), Edu_Cat: Secondary (3.916), Age_Sin (0.895), Desire_Child: Undecided (0.448), Edu_Cat: No Education (1.986) and More1Union (2.326) are significant at 5 percent; and Age_Gr: 30-34 (0.502), Occupation: Skilled Manual (0.306), Deli_Inst (0.345), Deli_Home (0.328), Birth_1yr (0.700), Employed (1.427) and Province: Madhesh (0.675) are significant at 10 percent

Model Binary A: In Model V_a, there are a total of 1445 observations. The Chi^2 value (217.637) is significant (p=0.000), pR^2 (0.620) is quite high and AIC/BIC (217.542/439.110) are quite low indicating that the model is good.

The model observes N5Child (0.058), EverBfed (0.004) and Birth_5yr (8.320); HHHead_Sex (3.4930) and Rur_Urb (0.360); and Lit_Par (4.044) are significant at 1, 5 and 10 percent respectively. Stepwise logistic regression analysis observes N5Child (0.125), Birth_5yr (6.974), EverBfed (0.006), Partner_CYS (0.730) and Desire (5.259); HHHead_Sex (3.493) and Rur_Urb (0.360); and Lit_Par (4.044) to be significant at 1, 5 and 10 percent respectively.

Model Binary B: This model identifies N5Child (0.182), CEB (1.453), Birth_5yr (8.749), Desire (5.137) and Child_Sex (1.920) are significant at 1 percent. Based on the model, a unit increase in the number of births in the past 5 years results in odds of childhood mortality to increase by 8.7 times. Also, the odds of childhood mortality for a male child is twice that of a female child. The odds also increase Desire and CEB but decrease for N5Child. Likewise, More1Union (2.105), Age_30_34 (0.534) and Lit (1.799) are significant at 10 percent.

Stepwise regression point-out Birth_5yr (8.189), Desire (5.468), CEB (1.470), N5Child (0.189), and Child_Sex (1.913); Partner_CYS (0.923) and More1Union (2.139); and Age_30_34 (0.515), Province: Madhesh (0.660), CYS (0.927), Rur_Urb (0.722), Lit (1.710) and Hindu (1.526) are significant at 1, 5 and 10 percent respectively. Based on the model, the

odds for childhood mortality increase for Birth_5yr (8.189), Desire (5.468), CEB (1.470), Child_Sex (1.913), and More1Union (2.139) and these values are significant at 5 percent. Likewise, the odds of childhood mortality decrease for N5Child (0.189) and Partner CYS (0.923).

Provincial Level Analysis

For provincial level analysis, the coverage percent is very important because of the sampling design and because the total sample size is to be distributed over the seven provinces. Keeping this in mind, Model V_b is selected for provincial level analysis. Province-wise coverage of the model is provided below as Table 4.

Table 4: Sample size and coverage of provincial model

Sample	Koshi	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudur Paschim	Total
Provincial Model	652	1050	608	409	736	847	778	5080
Total	800	1143	614	414	757	856	788	5372
Coverage (%)	81.50	91.86	99.02	98.79	97.23	98.95	98.73	94.56

Source: NDHS, 2022

Koshi Province: For Koshi Province, N5Child (0.077) and Birth_5yr (31.848) are significant at 1 percent while Child_Sex (3.598) and AC (5.832) are significant at 5 percent. Likewise, CEB (1.726), Desire (3.168) and Birth_1yr (3.080) are significant at 10 percent. Simultaneously, stepwise logistic regression analysis shows N5Child (0.084), Birth_5yr (21.111), Deli_Home (4.724) and Partner_CYS (0.831) are significant at 1 percent; AC (3.343), Child_Sex (3.413), Desire (3.881) and Employed (2.638) are significant at 5 percent; and Birth_1yr (2.003) and CEB (1.347) are significant at 20 percent.

Madhesh Province: For Madhesh Province, N5Child (0.319), Birth_5yr (4.799) and Desire (6.797) are significant at 1 percent; CEB (1.512) is significant at 5 percent; Age_30_34 (0.228) and Rur_Urb (0.5320) are significant at 10 percent. Likewise, stepwise logistic regression shows: Desire (7.188), Birth_5yr (5.570), N5Child (0.320) and Partner_CYS (0.890) are significant at 1 percent; CEB (1.505) is significant at 5 percent significant level. Deli_Home (0.471) and Age_30_34 (0.236) are significant at 10 percent. Hindu (2.188), Birth_1yr (0.550), Rur_Urb (0.592), Lit (1.610) and Preg_Ter (1.626) are significant at 20 percent.

Bagmati Province: For Bagmati Province, N5Child (0.002) is significant at 5 percent; and Birth_5yr (244.541), Rich (1246.786) and Desire (123.809) are significant at 10 percent. Stepwise logistic regression shows: N5Child (0.013), Age_Cohab (0.462), WIFS (1.000) and Rich (374.685) are significant at 1 percent; Desire (25.376), AB (10.812) and Birth_5yr (38.681) are significant at 5 percent; Hindu (11.412), Lit_Par (0.037) and Child_Sex (8.609) are significant at 10 percent; and Liv_Toget (7.383) is significant at 20 percent.

Gandaki Province: For Gandaki Province, adjusted logistic regression analysis is not possible because only 4 observations are available for data analysis. Stepwise logistic regression analysis shows: Age_30_34 (31.656), Birth_3yr (114.639), CEB (3.026) and Desire (719.429) are significant at 10 percent.

Lumbini Province: For Lumbini Province, N5Child (0.070) and Birth_5yr (29.639) are significant at 1 percent; Joint_Decision (0.203) and Desire (6.152) are significant at 5 percent; and Child_Sex (3.017) are significant at 10 percent. Stepwise logistic regression analysis shows: Birth_5yr (24.435), N5Child (0.086) and Desire (6.696) are significant at 1 percent; Joint_Decision (0.238) and Child_Sex (3.143) are significant at 5 percent; Deli_Home (0.100), CEB (1.631), Preg_Ter (0.190), Deli_Inst (0.152) and Birth_1yr (0.335) are significant at 10 percent; and Dalit (2.568) and CYS (0.896) are significant at 20 percent.

Karnali Province: For Karnali Province, N5Child (0.077) and Birth_5yr (30.567) are significant at 1 percent and Desire (9.124) are significant at 10 percent. Stepwise logistic regression shows: Birth_5yr (11.753), N5Child (0.143) and CEB (1.847) are significant at 1 percent; Desire (6.411) is significant at 10 percent; Deli_Inst (0.115), Child_Sex (3.705) and Deli_Home (0.092) are significant at 20 percent.

Sudur Paschim Province: For Sudur Paschim Province, N5Child (0.040) and Birth_5yr (40.335) are significant at 1 percent; and Child_Sex (3.560) and Child_Twin (12.820) are significant at 10 percent. Stepwise logistic regression shows: Birth_5yr (22.643) and N5Child (0.051) are significant at 1 percent; Child_Sex (3.268) is significant at 10 percent; and Dalit (0.184), Age_1Birth (0.851) and Child_Twin (6.939) are significant at 20 percent.

CONCLUSION

High odds ratio values for mothers with higher CEB and number of births in the past five years suggest this. Similarly, the odds ratio values for the number of children under 5 years of age in a household suggest that more the number of children, lesser the odds of childhood mortality. The most plausible explanation for this could be that in joint families, where CEB and number of births in the past 5 years need not be necessarily high for an individual women but when accumulated for different women residing in the household increases the total number of children under 5 years of age, children get better care form at least a member of the household. Also, if sex of the child is known before delivery, special care must be given to male prenatal and his mother. The odds of childhood mortality decrease for women with higher CYS and whose partner have higher CYS reiterating the importance of education in reducing childhood mortality. Also, the odds of childhood mortality for women who are in more than 1 union is double than those in single union and 1.5 times more for Hindu women. Provincial analysis suggests that Hindu Dalit and Hindu other Tarai caste groups specifically in rural areas should be prioritized (reducing childhood mortality and improve maternal/child health).

For all the Provinces, women should be encouraged to have lesser children with adequate child spacing. Special attention should be given if a male child is delivered. Married women of reproductive ages should be encouraged to have fewer children with a proper child spacing.

The concept of joint family should be promoted because the greater the number of children in a household, the lesser the odds of childhood mortality. Also, women should be discouraged in engaging in more than one union.

REFERENCES

Bell, D. (1985). What Policies Will Reduce Death Rates Most Rapidly in Less Developed Countries?. Health Policy, Social Policy and Mortality Prospects, 493-506.

Bhattarai, K. D. (2008). Determinants of Acute Respiratory Infection among Children under Age Five Years in Nepal [Unpublished doctoral dissertation]. Faculty of Humanities and Social Sciences, Tribhuvan University, Kathmandu.

Blanc, A. K. (1991). Demographic and Health Surveys, World Conference, August 5-7, 1991, Washington D.C., Executive Summary. Maryland: IRD/Macro International.

Caldwell, J. C. (1979). Education as a Factor in Mortality Decline: an Examination of Nigerian Data. Population Studies, 33 (3), 395-415.doi???

Caldwell, J. C. (1986). The Role of Mortality Decline in Theories of Social and Demographic Transition. Consequences of Mortality Trends and Differentials, 31-42.

Caldwell, J. C. (1991). Routes to Low Mortality in Poor Countries. Health Transition Series, 1-37.

Caldwell, J.C. and P. McDonald (1981). "Influence of Maternal Education in Infant and Child Mortality: Levels and Causes," Proceedings of the International Conference (Manila: IUSSP), 2: 79-96.

Garenne, M., & Vimard, P. (1984). Un Cadre Pour L'analyse des Facteurs de la Mortalite des Enfants . Cahiers de L'ORSTOM, Serie Sciences Humaines, 305-310.

Ghimire PR, Agho KE, Ezeh OK, Renzaho AMN, Dibley M, Raynes-Greenow C. Under-Five Mortality and Associated Factors: Evidence from the Nepal Demographic and Health Survey, 2001-2016. Int J Environ Res Public Health. 2019 Apr 8;16 (7): 1241. doi: 10.3390/ijerph16071241. PMID: 30965556; PMCID: PMC6479835.

Gubhaju, B. B. (1991). Child Mortality and Child Survival in South Asia: Nepalese Prospective. New Delhi: Anil Mittal, Daya Publishing House.

Haider, B.A.; Olofin, I.; Wang, M.; Spiegelman, D.; Ezzati, M.; Fawzi,W.W. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: Systematic review and meta-analysis. BMJ 2013, 346, f3443.

ICF. (2018). Demographic and Health Surveys Standard Recode Manual for DHS7. The Demographic and Health Surveys Program. Rockville, Maryland, U.S.A.: ICF

Imdad, A.; Bhutta, Z.A. Routine iron/folate supplementation during pregnancy: Effect on maternal anaemia and birth outcomes. Paediatr. Perinat. Epidemiol. 2012: 26, 168–177.

Kamal, S.M. What is the association between maternal age and neonatal mortality? An analysis of the 2007 Bangladesh Demographic and Health Survey. Asia Pac. J. Public Health 2015: 27, 1106–1117.

Kanel, P. (2010). Determinants of Under-Five Mortality in Nepal: A Logit Analysis. unpublished M.A. thesis submitted to the Central Department of Population Studies. Kathmandu: Tribhuvan University.

Kramer, M. S. (1987). Determinants of Low Birth Weight: Methodological Assessment and Meta-Analysis. Bulletin of the World Health Organization, 65 (5), 663-737.

Luther, N. Y., & Thapa, S. (1999). Infant and Child Mortality in Nepal. Kathmandu: Family Health International, Population and Reproductive Health, Research and Technical Services Office.

Masuy-Stroobant, G. (1983). Les Determinants de la Mortalite Infantile. La Belgique D'hier et D'aujourd'hui. Louvain-la-Neuvre: CIACO.

Masuy-Stroobant, G. (2006). The Determinants of Infant Health and Mortality. In G. Caselli, J. Vallin, & G. Wunsch, Demography: Analysis and Synthesis (pp. 71-79). London: Elsevier Inc.

McKeown, T. (1976). The Modern Rise of Population. London: Edward Arnold.

Meegama, S. A. (1980). Socio-economic Determinants of Infant and Child Mortality in Sri Lanka: An Analysis of Post-war Experience. London: World Fertility Survey.

Ministry of Health [Nepal], New ERA, and ORC Macro. Nepal Demographic and Health Survey 2001; Family Health Division, Ministry of Health, New ERA, and ORC Macro: Calverton, MD, USA, 2002.

Ministry of Health and Population (MOHP) [Nepal], New ERA, and Macro International Inc. (2007). Nepal Demographic and Health Survey 2006. Kathmandu: Ministry of Health and Population (MOHP) [Nepal], New ERA, and Macro International Inc.

Ministry of Health and Population (MOHP) [Nepal], New ERA, and ICF International Inc (2011). Nepal Demographic and Health Survey 2011; Ministry of Health and Population, New ERA, and ICF International: Kathmandu, Nepal; Calverton, MD, USA, 2012.

Ministry of Health and Population [Nepal], New ERA, and ICF. (2023). Nepal Demographic and Health Survey 2022. Kathmandu, Nepal: Ministry of Health and Population [Nepal].

Ministry of Health and Population (MoHP). (2067 BS). Population Perspective Plan, 2010-2031. Kathmandu: MoHP.

Mosley, W. H., & Chen, L. C. (1984). An Analytical Framework for the Study of Child Survival in Developing Countries. Population and Development Review, 10, 25-45.

Omran, A. R. (1971). The Epidemiologic Transition: A Theory of the Epidemiology of Population Change. Milbank Memorial Fund Quarterly, 49 (4), 509-538.

Omran, A. R. (1981). The Epidemiologic Transition. (J. A. Ross, Ed.) International Encyclopedia of Population, 172-175.

Palloni, A. (1985). Health Conditions in Latin America and Policies for Mortality Change. (J. Vallin, A. Lopez, & H. Behm, Eds.) Health Policy, Social Policy and Mortality Prospects, 465-492.

Palloni, A. (1987). Theory, Analytical Frameworks and Causal Approach in the Study of Mortality at Young Ages in Developing Countries. Annales de la Societe Belge de Medecine Tropicale, 31-45.

Pandey, A., Choe, M. K., Luther, N., Sahu, D., & Chand, J. (1998). Infant and Child Mortality in India. National Family Health Survey - Subjects Report Number 11. International Institute of Population Sciences. Mumbai, India, and East-West Center Program on Population. Honolulu, Hawaii (December 1998).

Paudel, D., A. Thapa, P. R. Shedain, and B. Paudel. 2013. Trends and determinants of neonatal mortality in Nepal: Further analysis of the Nepal Demographic and Health Surveys, 2001-2011. Calverton, Maryland, USA: Nepal Ministry of Health and Population, New ERA, and ICF International.

Saha, U.R.; van Soest, A. Contraceptive use, birth spacing, and child survival in Matlab, Bangladesh. Stud. Fam. Plann. 2013, 44, 45–66.

Singh, Samikshya, Gambhir Shrestha, Deepak Joshi, and Tesfayi Gebreselassie. 2019. Childhood Illness and Mortality in Nepal: Trends and Determinants. DHS Further Analysis Reports No. 120. Rockville, Maryland, USA: ICF.

StataCorp. 2017. Stata: Release 15. Statistical Software. College Station, TX: StataCorp LLC.

Thapa, Shyam (2008). "Declining Trends of Infant, Child and Under-five Mortality in Nepal," Journal of Tropical Pediatrics, 54(4): 265-268.

Vasey, D. E. (1997). An Estimate of Neonatal Tetanus Mortality in Iceland. European Journal of Population, 13 (1), 49-69.www.undp.org.np/mdgindicator.html (accessed on 23 December 2009).